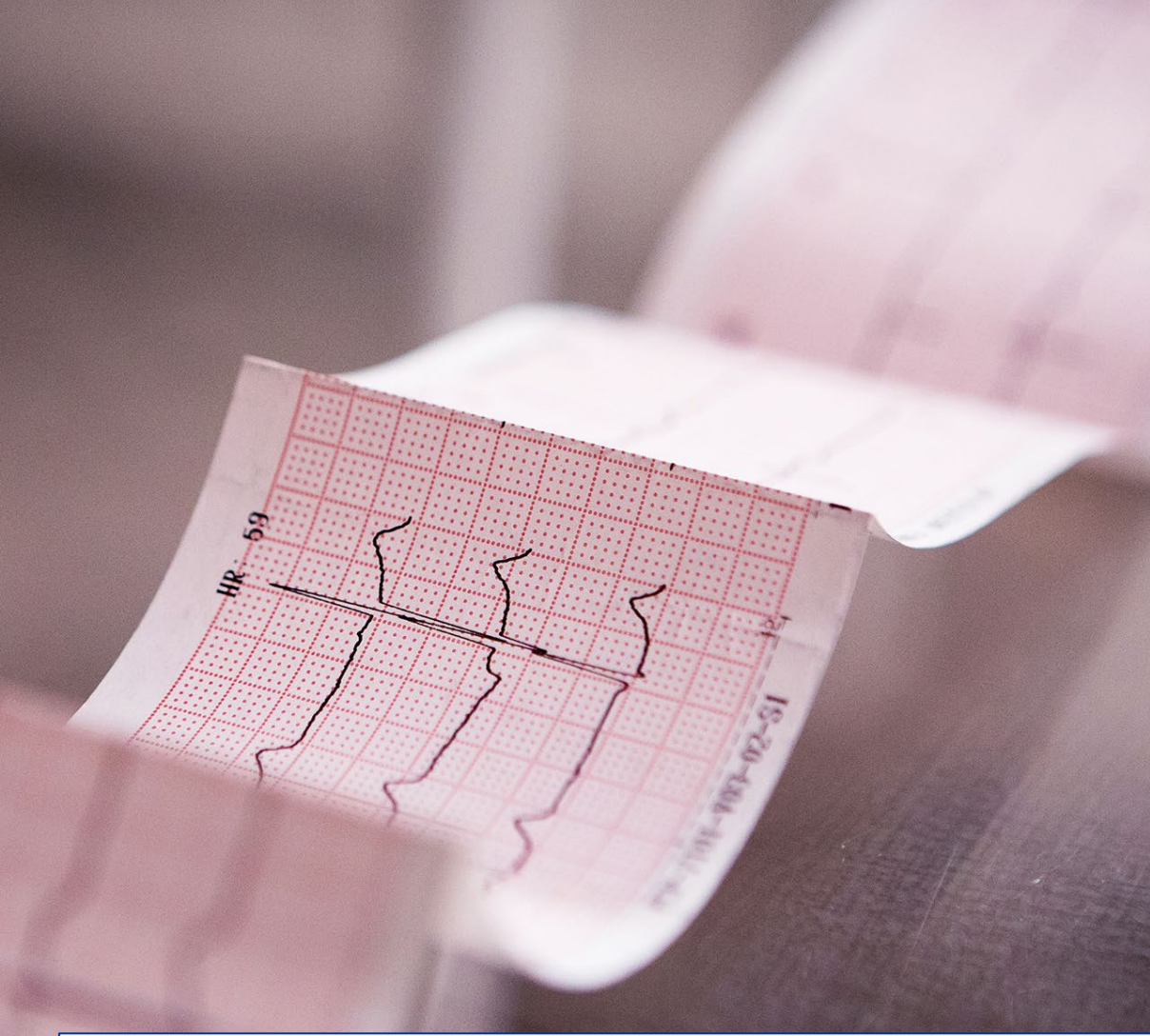




AI in cardiovascular care

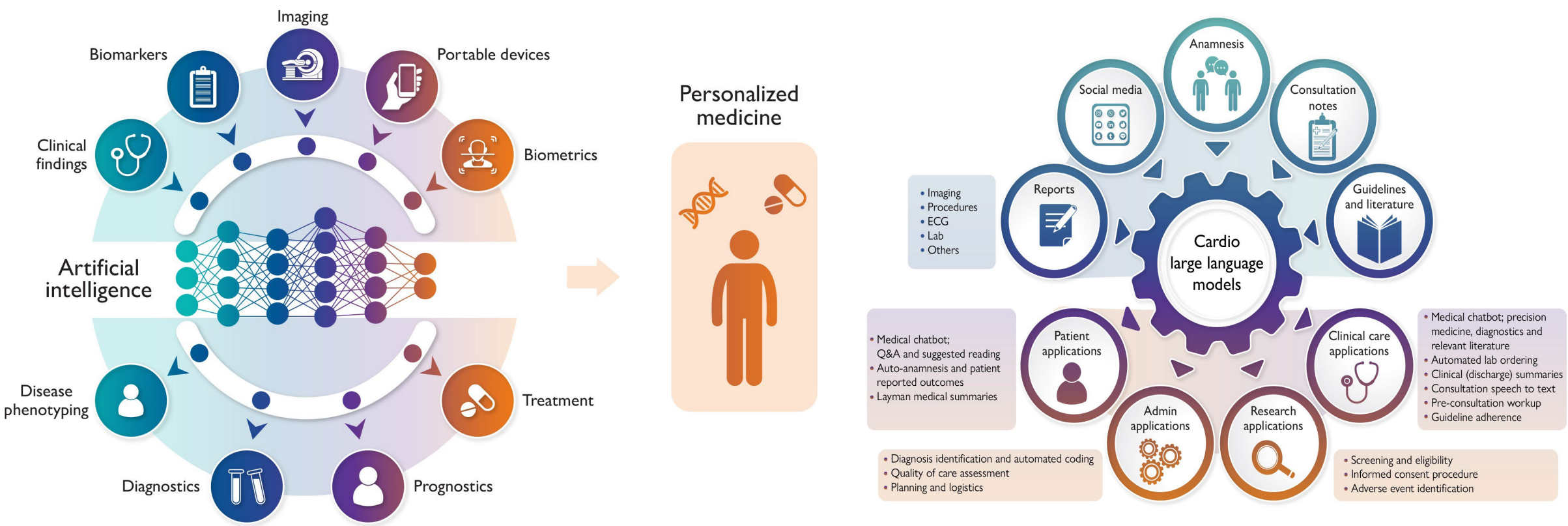
*From development to
implementation – a roadmap
for EU-wide deployment of AI in
CV care*

Prof. Folkert **Asselbergs**

Chair | Digital Cardiology and AI Committee of the ESC

Artificial intelligence in cardiovascular medicine: clinical applications

Artificial intelligence: revolutionizing cardiology with large language models



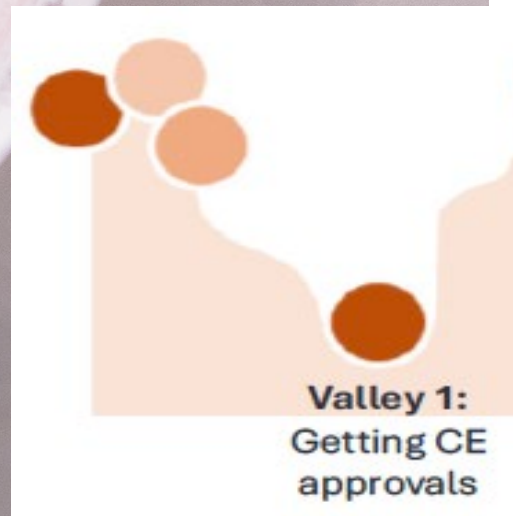
Eur Heart J, 2024 4291–4304

European Heart Journal. 2024: 332–345

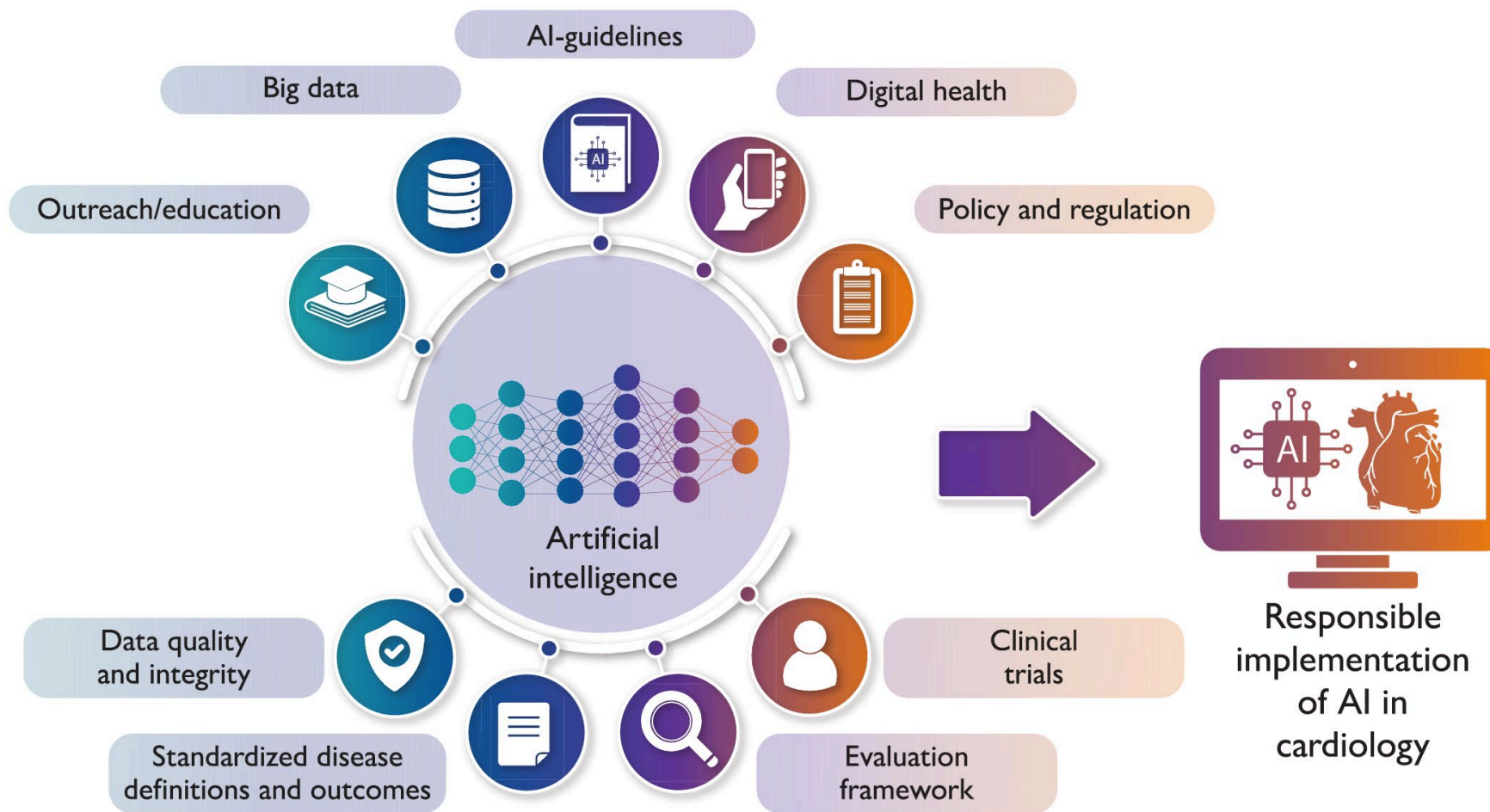
From potential to implementation

Potential $\neq$ implementation

The three “valleys of death”



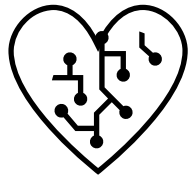
Artificial Intelligence in Cardiology: A Roadmap of ESC



Digital Cardiology and AI: Guidelines

Supporting assessment and usage of AI in cardiology in collaboration with the Clinical Practice Guidelines committee

Assessment of AI in ESC Guidelines



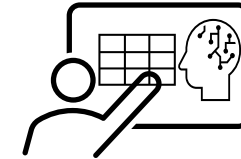
Developing evidence
assessment concepts
for AI-based clinical
solutions

Guideline Digitalization



Digital representation
and interaction with
guidelines

AI Support for Guideline Task Forces



Support research
and generation of
evidence tables with
AI tools

ESC chat

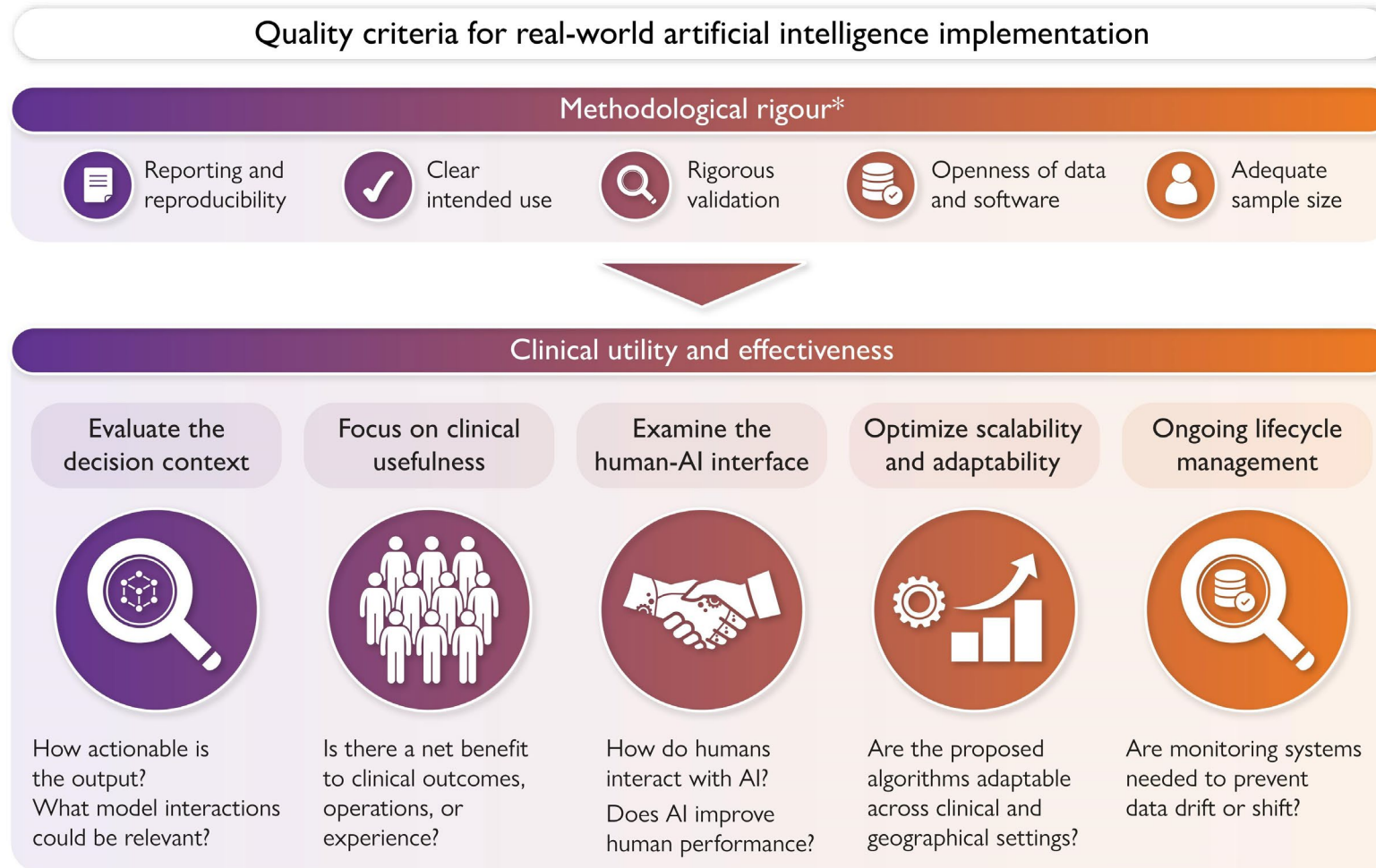
**The ESC
Guidelines
companion
designed
for you**



**Underlines
delivery of
high-quality care**



Standards are needed

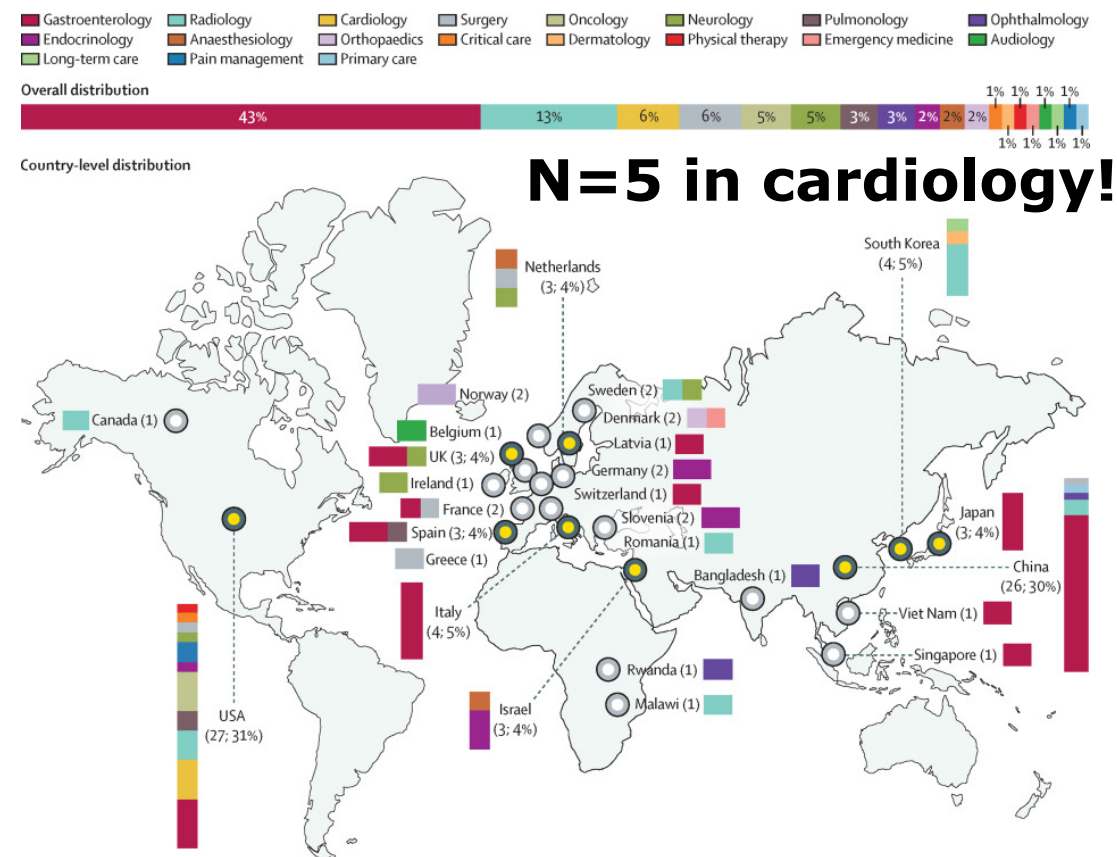


AI, artificial intelligence; *, Van Royen FS, et al. *European Heart Journal*.

Oikonomou EK, et al. *European Heart Journal*.

Eur Heart J, ehag121, <https://doi.org/10.1093/eurheartj/ehag121>

Randomized Clinical Trials urgently needed to grade level of evidence for AI algorithms



Classes of recommendations

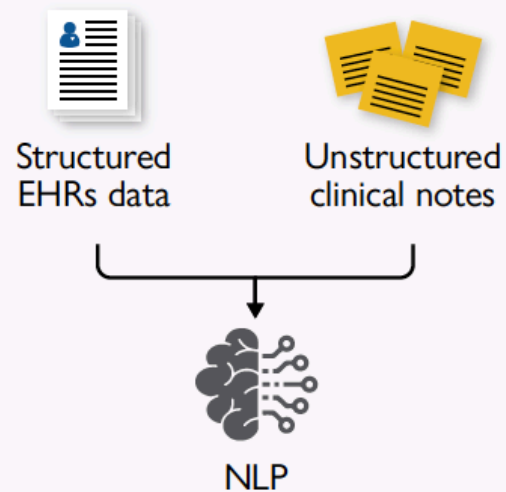
Definition		Wording to use
Class I	Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.	Is recommended or is indicated
Class II	Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure.	
Class IIa	Weight of evidence/opinion is in favour of usefulness/efficacy.	Should be considered
Class IIb	Usefulness/efficacy is less well established by evidence/opinion.	May be considered
Class III	Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.	Is not recommended

Lancet Digit Health 2024; e367–73

Rapid-cycle, pragmatic RCT's needed for AI validation

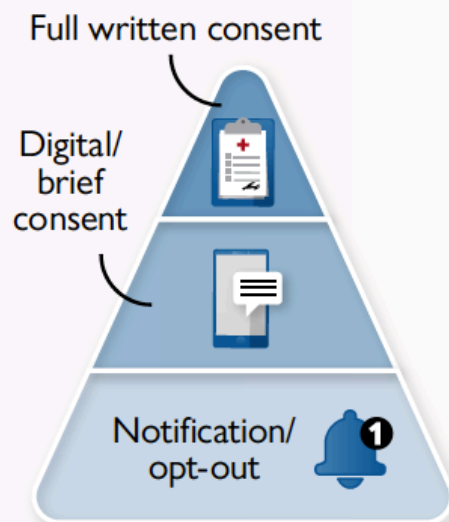
Digital integrated trials pipeline

Automated screening facilitating recruitment



Automated EPR screening uses NLP on structured data and clinical notes to continuously flag trial-eligible

Proportionate consent



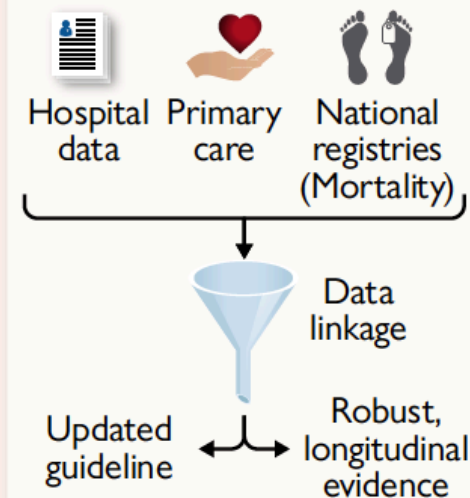
Consent is matched to trial risk, using notifications, brief digital consent or full written consent

Point-of-care randomization



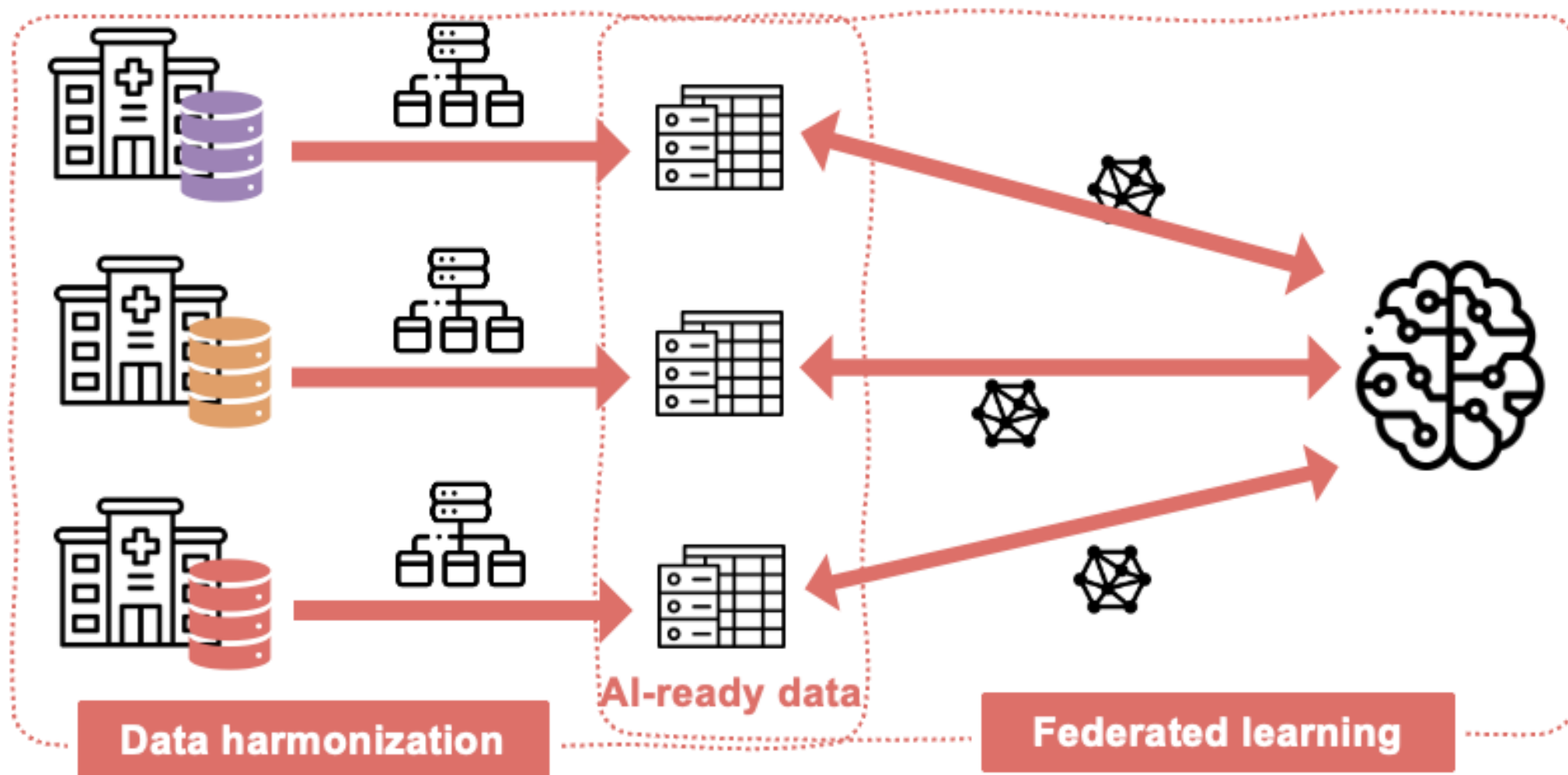
Randomization is delivered through the EPR at the moment of care (Randomize/Defer/Override)

Outcome ascertainment and evidence generation



Linked routine data are used to follow participants over time and translate encounters to evidence

Digital trial network needed



CENTRAL ILLUSTRATION Artificial Intelligence-Enhanced Electrocardiogram Models for Detection of Left Ventricular Dysfunction - A Comparison Study

We Propose a Novel Framework for the Independent Validation of AI-ECG

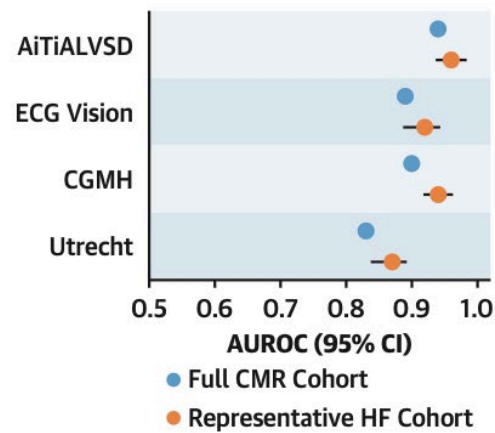
Out of 51 AI-ECG for LVSD Models Identified, Four Were Available for External Validation



Validation in a Cohort With ECGs and Paired Cardiac Magnetic Resonance Imaging



Performance Remained Excellent



Conclusions

AI-ECG shows strong discrimination in independent external validation using CMR

Limited openness of models limits the independent assessment AI-ECG and impedes further adoption

Croon PM, et al. JACC Adv. 2026;5(2):102572.

- Comparative studies needed
- Benchmarking data for external validation
- Representativeness
- Post-deployment evaluation
- AI passport



A living record of the full lifecycle of AI models

Captures structured metadata from study definition to deployment and passport generation.



Promotes transparency and traceability in healthcare AI

Tracks how data is used, models are built, and decisions are made throughout development.



Supports reproducibility and consistent model governance

Documents model configurations, parameters, and evaluation metrics for auditability.



Bridges technical documentation and stakeholder needs

Provides both detailed machine-readable metadata and user-friendly reports.



Aligns with established standards and ethical design principles

Integrates W3C PROV, PROV-ML, Model Cards, and FUTURE-AI guidelines.



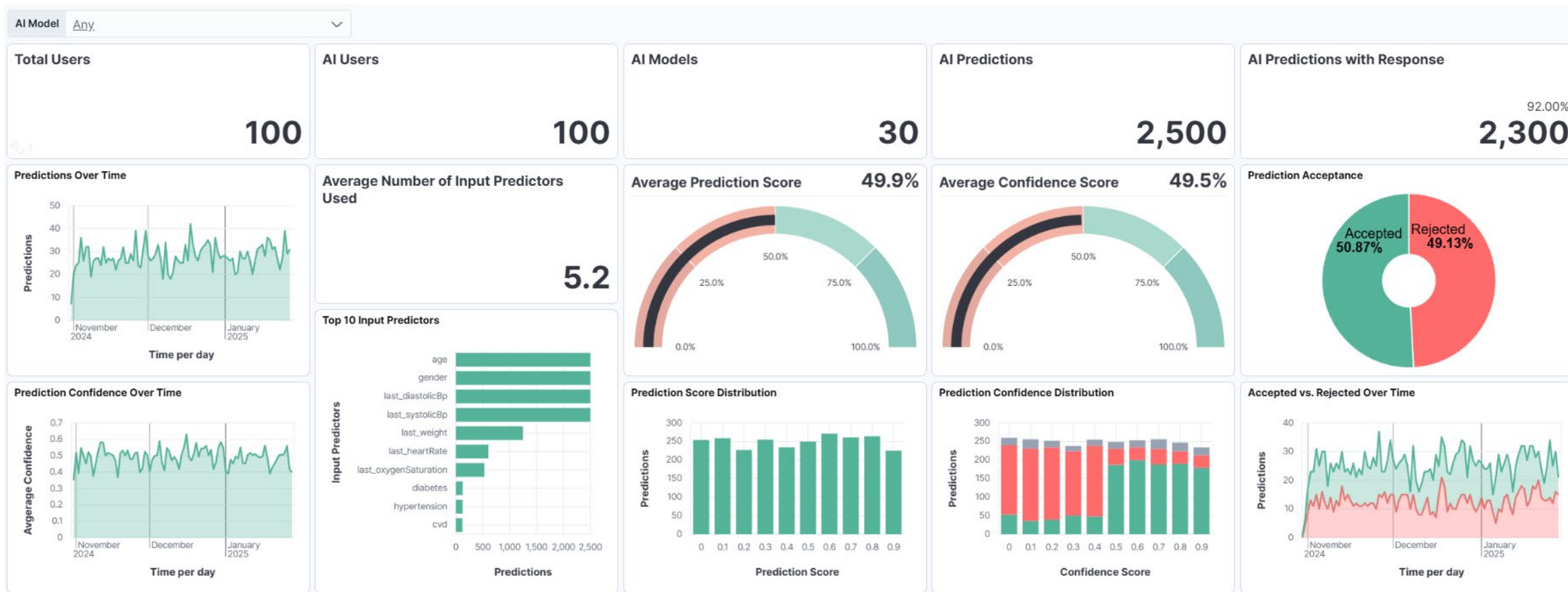
Serves as a baseline reference for continuous oversight

Captures deployment-time details to support tracking of changes and guiding future updates.





Continuous monitoring



AI4HF

Data foundations and regulatory clarity



**Access to high-quality data is key:
Interoperability is slowed by data fragmentation**

Need for improved legal clarity

- **Evidence** requirements,
- Coherent and clear legal framework for **liability** and accountability,
- **Post-marketing** monitoring.



Need for AI-tailored regulation

- Ongoing **performance monitoring** within routine healthcare,
- **Detection of drift**, bias and unintended effects,
- **Integration** into **post-market** surveillance systems.

Towards a coordinated European approach

Role of clinicians and

- **Defining** clinically **meaningful** endpoints and phenotypes,
- **Supporting** independent validation,
- **Ensuring integration** into clinical workflows.

Contributions from

- **Supporting** common **frameworks** for evaluation and use,
- **Incorporating AI** into clinical **guidelines** and standards,
- **Facilitating** training and capacity building.

coordinated, multi-stakeholder approach

- **Common data standards** and **infrastructures**,
- Shared **evaluation frameworks**,
- Practical **deployment** guidance for healthcare systems.